

*Unable to  
render  
ART 34 ANDT  
page for  
substitution*

brightness distribution is formed only in the vertical direction of the display screen. However, the backlight units do not implement two-dimensional characteristics in accordance with visual sense characteristics of a man as provided by a display device using a cathode-ray tube, that is, brightness distribution characteristics with gradient being formed at least in the horizontal and vertical directions from the central portion of a screen. Therefore issues of visual uncomfortableness and fatigability for a man have not been improved yet.

The present invention is conceived considering the aforementioned situation, and is intended for providing, in accordance with visual sense characteristics of a man, a backlight unit that enables rendering of images that are not uncomfortable to a man and not easily fatigable by forming brightness gradient at least in the horizontal and vertical directions so that the brightness of the central portion of the screen and in the vicinity thereof is relatively higher than the brightness at the peripheral portion, which is provided by a display device with a cathode-ray tube, and also a liquid crystal display device using the backlight.

Patent Document 1: Japanese Laid-Open Patent  
Publication No. H06-75216

Patent Document 2: Japanese Laid-Open Patent  
Publication No. H11-119217

## DISCLOSURE OF THE INVENTION

A first technological means of the present invention for a backlight unit for illuminating an object to be illuminated using a plurality of light sources disposed directly below the object to be illuminated is characterized in that the backlight unit has a reflection portion for causing the light from the plurality of light sources to exit in a certain direction, the reflection portion comprises at least a first and second reflection layers each having a predetermined level of light reflectance and transmittance, the reflection portion consists of a first region with the first and second reflection layers being overlapped in the light incident direction located at a position equivalent to the central portion on the surface to be illuminated of the object to be illuminated and a second region having the first reflection layer only, and brightness gradient is formed in the horizontal and vertical directions on the surface to be illuminated of the object to be illuminated by controlling the reflectance of the reflection portion using the first region providing a relatively higher reflectance and the second region providing a lower reflectance than the first region.

A second technological means of the present invention for a backlight unit for illuminating an object to be illuminated using a plurality of light sources disposed directly below the object to be illuminated is characterized in that the backlight unit has a reflection portion for causing the light from the plurality of light sources to exit in a certain direction, the reflection portion comprises at least a first and second reflection layers having a predetermined level of light reflectance and transmittance, the reflection portion consists of a first region with the first and second reflection layers that are overlapped in the light incident direction at a position equivalent to the central portion in the horizontal direction on the surface to be illuminated of the object to be illuminated and a second region with the first reflection layer only at both the edge portions, and brightness gradient is formed in the horizontal and vertical directions on the surface to be illuminated of the object to be illuminated by controlling the reflectance of the reflection portion in the horizontal direction of the surface to be illuminated using the first region providing relatively higher reflectance and the second region providing lower reflectance than the first region, and by setting the brightness of the light sources located at a position equivalent to the central portion in the vertical direction of the surface to be

illuminated relatively higher than the brightness of the light sources located at both the edge portions.

A third technological means of the present invention for a backlight unit for illuminating an object to be illuminated using a plurality of light sources disposed directly below the object to be illuminated is characterized in that the backlight unit has a reflection portion for causing the light from the plurality of light sources to exit in a certain direction, the reflection portion comprises at least a first and second reflection layers having a predetermined level of light reflectance and transmittance, the reflection portion consists of a first region with the first and second reflection layers that are overlapped in the light incident direction at a position equivalent to the central portion in the vertical direction of the surface to be illuminated of the object to be illuminated and a second region with the first reflection layer only at both the edge portions, and brightness gradient is formed in the horizontal and vertical directions on the surface to be illuminated of the object to be illuminated by controlling the reflectance of the reflection portion in the vertical direction of the surface to be illuminated using the first region providing relatively higher reflectance and the second region providing lower reflectance than the first region, and also by setting the brightness of the

light sources located at a position equivalent to the central portion in the horizontal direction of the surface to be illuminated relatively higher than the brightness of the light sources located at both the edge portions.

A fourth technological means of the present invention for a backlight unit for illuminating an object to be illuminated using a plurality of light sources disposed directly below the object to be illuminated is characterized in that the plurality of light sources comprise LEDs, and brightness gradient is formed in the horizontal and vertical directions on the surface to be illuminated of the object to be illuminated by controlling the radiation brightness of the LEDs in each of the regions formed on the substrate of the backlight unit.

A fifth technological means of the present invention is the technological means according to the fourth technological means which is characterized in that the radiation brightness of the LEDs differs among regions that are concentrically formed around the central portion of the substrate of the backlight unit and in the vicinity thereof.

A sixth technological means of the present invention is a liquid crystal display device which is characterized in that the liquid crystal display device has the

ART 34 AMDT

backlight unit implemented by the fourth or fifth technological means and a liquid crystal panel to be illuminated by the backlight unit.

A seventh technological means of the present invention for a backlight unit for illuminating an object to be illuminated using a plurality of light sources disposed directly below the object to be illuminated is characterized in that the backlight unit has a reflection portion for causing the light from the plurality of light sources to exit toward a certain direction, the reflection portion comprises at least a first and a second reflection layers having a predetermined level of light reflectance and transmittance, the reflection portion consists of a first region with the first and second reflection layers being overlapped in the incident direction of light located at a position equivalent to the central portion in the horizontal direction on the surface to be illuminated of the object to be illuminated and a second region consisting of the first reflection layer only located at the both ends, and brightness gradient is formed in the horizontal and vertical directions on the surface to be illuminated of the object to be illuminated by controlling reflectance of the reflection portion in the horizontal direction on the surface to be illuminated and also by making the clearance of the light sources located at the position

equivalent to the central portion in the vertical direction on the surface to be illuminated relatively smaller than the clearance of the light sources located at the both ends, using the first region with relatively higher reflectance and the second region with lower reflectance than the first region.

An eighth technological means of the present invention for a backlight unit for illuminating an object to be illuminated using a plurality of light sources disposed directly below the object to be illuminated is characterized in that the backlight unit has a reflection portion for causing the light from the plurality of light sources to exit toward a certain direction, the reflection portion comprises at least a first and a second reflection layers having a predetermined level of light reflectance and transmittance, the reflection portion consists of a first region with the first and second reflection layers overlapped in the incident direction of light located at a position equivalent to the central portion in the vertical direction on the surface to be illuminated of the object to be illuminated and a second region consisting of the first reflection layer only located at the both ends, and brightness gradient is formed in the horizontal and vertical directions on the surface to be illuminated of the object to be illuminated by controlling reflectance of the